METEOROLOGY AND AERONAUTICS.

The *"Air Service Information Circular (Heavier-than-air)"* published by the Director of the Air Service at Washington, under date of May 12, 1920, contains an interesting statement of the kind of meteorological information that is required in the location, layout and maintainance of heavier-than-air flying fields. The meteorologist who is not in personal touch with the practical problems confronting the aviator is prone to neglect or to fail to recognize certain climatological or meteorological aspects of the aviator's work.

The circular is evidently intended to be of service to the aviator or engineer confronted with the task of selecting landing fields, or to the army meteorologist whose duty it is to supply the current meteorological data after the field is in operation. The methods employed by the Meteorological Section of the Signal Corps in France are presented, together with some of the charts which were found useful during the war, namely, the light chart, showing daylight, twilight, moonlight, and starlight, and the chart of magnetic declination. At the end is a short bibliography on aerology and meterology.

As a guide to these men in the service whose work falls along this line, this circular may serve a useful purpose. But to the meteorologist this concise statement from the flyer as to what he wishes to know about meteorology should serve as a timely guide as to the direction along which he should proceed. In France, J. Rouch has prepared a booklet entitled *"Préparation Météorologique des Voyages Aeriens."* There is a field for a similar but more comprehensive work in the United States.—*C. L. M.*

FLYING OVER CLOUDS IN RELATION TO COMMERCIAL AERONAUTICS.[1]

By Prof. B. MELVILLE JONES.

[Abstract and excerpts from a brief of this paper in *Aeronautics*, Mar. 18, 1920, pp 240-243.]

The problems confronting the aviator on a long distance flight, when there is a heavy cloud layer quite close to the ground, are manifold. The author inclines toward the view that flying above the clouds has many advantages over flying below clouds, and this view was also held to a greater or less degree by those who participated in the discussion. The difficulties of undercloud flying as enumerated by the author are:

"1. Strain to pilot. [Poor visibility, bumpiness, proximity to earth.]

"2. Danger of collision. [A growing problem, accentuated by poor horizontal visibility.]

"3. Discomfort to passengers and pilots. [Flying above clouds exhilarating; below is depressing.]

"4. Loss of power to use favorable winds. [Choice of altitudes limited.]

"5. Annoyance to people on ground. [As routes become definitely established the noise of high-powered engines would be annoying.]

"6. Danger in forced landings." [One may have a better idea of the nature of the land when flying low, but this would be offset by two advantages from flying above clouds, namely, time to remedy slight mechanical troubles in the air without completing the landing, and, if the pilot were familiar with surface wind direction, opportunity to turn aeroplane so as to land against the wind.]

The difficulties of flying above clouds are also enumerated:

"1. Difficulty of actual in-cloud flying. [Loss of sense of balance by pilot is now being overcome by new instruments.]

"2. Danger that the clouds might come to the ground whilst the aeroplane was in or above them.

"3. Difficulty of navigation. [Must be carried out by dead reckoning, astronomical observation, observation of kite balloons or other guide marks, or wireless.]

"4. Difficulty of finding aerodrome at end of flight.

"5. Danger of collision in clouds.

"6. Possibility of having to reach great heights to clear clouds. [Uncomfortable temperatures and physiological effects.]

"7. Danger from storm clouds."

While this paper discussed the entire problem from the standpoint of commercial aeronautics, and the mobilization of resources and organization to assist in commercial aviation, it is important to note that the paper was occasioned purely by meteorological phenomena. Also, of the 13 dangers enumerated under the heads of undercloud and overcloud flying, seven are directly the result of meteorological conditions, while the remaining five are physiological and mechanical. This emphasizes the fact that the aviator is more dependent upon his understanding of meteorological phenomena than upon all other factors combined, if he will fly with the greatest safety and comfort.

The paper was followed by a discussion[2] in which some of the foremost British aviation authorities participated. Among other points brought out by these men there were several regarding the meteorological organization which will permit of greater safety in flying. One of the points of discussion was how to have a continuous record of wind speed above the clouds. Maj. Dobson said that an instrument for use on a kite balloon had been developed which might give some assistance in this direction, and that a modification of it was desirable which would permit of the recording devices registering at the ground continuously. This would do away with the necessity of hauling the balloon down.

Mr. J. R. Pannell brought out an important point concerning the use of altimeters on long flights. While the pilot is in the air, the barometric pressure may change, with the consequence that his altimeter reading, which was last set before he ascended, might be as much as 300 feet in error. If he is traveling over land whose elevation is variable, his altimeter does not indicate height above the surface, but height above the starting point. To correct this difficulty, changes of surface barometric pressure should be given to the plane by wireless, thus allowing the aviator to make the necessary correction. If there were a means of independently knowing the height, a record of barometric change could be made on the craft. This would be of great advantage to a dirigible on a cruise of several days.

The author summarizes the discussion as follows:

"1. That the power to fly in safety over clouds would be of great value to the commercial value of aviation.

"2. That routine flying over clouds can not be undertaken safely with the facilities at present available to the commercial world.

"3. That probably it could be made safe with a suitable organization of ground stations and meteorology and provided that reliable instruments were more generally available * * *."

[1] Paper read before the Royal Aeronautical Society, March 3, 1920; published in full in Aeronautical Journal, May, 1920, pp. 220-249.

[2] Published in *Aero. Journ.*, loc. cit., pp. 238-247.

The author strongly urged the development of new methods and instruments, in order that commercial aviation in England be made practicable. The island location, with the general unfavorable weather, especially during the winter months, has placed England in a rather disadvantageous position in commercial flying and, for that reason, there should be no cessation of activities in improving the methods and instruments used.—*C. L. M.*

THE EFFECT OF BAROMETRIC PRESSURE UPON ALTIMETER READINGS.

In discussing Prof. B. Melville Jones's paper on "Flying over clouds in relation to commercial aeronautics,"[1] Mr. J. R. Pannell brought up the question of the effect upon aircraft altimeter readings of changes in barometric pressure while the craft is in flight. This is especially important in relation to flying on cloudy or foggy days, or days with low visibility. The point seems worthy of emphasis.

A free balloon is, as its name implies, a balloon which rides freely in the air without means of propulsion or steering. It is interesting to note that, for the balloonist maintaining a nearly constant moderate elevation, the question of erroneous altimeter readings caused by difference of barometric pressure between his point of departure and destination, does not arise. It is a well-known fact that the so-called gradient winds blow in a direction parallel to the isobars at levels above those influenced by the friction of the earth's surface. If a balloon rises into such a current its course must also lie along some isobar. Of course, this is not strictly true when the balloon has flown so low that the surface friction has interfered with the wind direction, nor so high that the isobars are greatly different from those at the surface. This implies a range of about 2,000 feet and sometimes more (1,500 feet to 3,500 feet) in which the balloonist may fly without danger of erroneous altimeter readings. This is a point, to which, it is believed, free balloonists have not given much attention.

But, with dirigible balloons and airplanes, this relation does not obtain, for these craft can be steered quite independently in any direction, so that they may take off in one type of pressure formation and land in another. In such cases, it is of vital importance to consider the changes which may have taken place during the flight at the destination and at points along the route. For example, let us consider an airplane flying from New York to Chicago. Suppose the pressure at New York is 30.40 inches at the time of departure and that at Chicago is 30 inches at time of landing (such gradients are not uncommon). The New York field is about 600 feet lower than that at Chicago. If then, with the barometer at 30.40 inches in New York, the aviator sets his altimeter at 0, what will it read when he lands in Chicago? If he thinks only of the elevation of the land, he may assume that the answer would be 600 feet. But if he also considers the possible effect of changing pressure, he will discover that on a summer day, with a temperature of 75° F., a difference of 0.40 inch in the barometer is equivalent to a height of about 380 feet. Hence, instead of his altimeter reading 600 feet when he lands, it will read 980 feet.

The airplanes arriving at Chicago from the east fly across the lower end of Lake Michigan and are for about 20 miles above the lake. If there is a sheet of stratus cloud over the whole region and the aviator, aware that he is in the vicinity of Chicago, decides to descend through this sheet in order to locate himself, forgetting that he should allow for lower barometric pressure at Chicago, he may be unpleasantly surprised to find the waves of Lake Michigan facing him about 400 feet above the altitude he expected, and it may be too late to save himself from a dip in the lake. If he is over land, a crash may result.

Thus when a plane or dirigible is flying for long distances over land it is worth while for the pilot to form some opinion as to the possible changes in barometric pressure along his route and at his destination during the time he is in flight. This will enable him to make corrections for his altimeter readings which will be approximately correct, and certainly will keep him from experiencing such surprises as that mentioned above. The experience of Lieut. Edward V. Wales, who lost his life in the transcontinental air race in 1919 by crashing into a Wyoming mountain in a snowstorm, is typical of accidents which may result.

After all, the quantity measured by the altimeter is not altitude but pressure. Errors as great as 500 feet are easily conceivable on long flights, and when the flight is over a rough terrain with low clouds, it is a factor which can not be neglected.—*C. Le Roy Meisinger.*

[1] Abstract in this REVIEW, pp. 528-529.

METEOROLOGICAL ASPECTS OF THE RECRUITING TRIP OF THE NC-4.

By Lieut. J. B. ANDERSON.

[Pensacola, Fla., Sept. 7, 1920.]

SYNOPSIS.

The Navy Department, during the months September to January, 1919-20, detailed the naval seaplane *NC-4* to make a recruiting trip along the Atlantic coast from Maine to Florida, thence westward to New Orleans, up the Mississippi and Ohio Rivers to Cincinnati and return, ending the flight at Pensacola. The meteorological officer based his forecasts upon the daily weather map combined with the local conditions, and frequently consulted with Weather Bureau officials along the route. Much of the trip was made in unfavorable or stormy weather. Interesting experiments were made with the wireless apparatus concerning the static electricity before a rain, and in determining the direction of thunderstorms. The air was found to be steadier during the inland journey up the rivers than along the coast. The final flight extended to Rockaway Beach, N. Y., contrary to the original plan, and the flight was made in extremely rough weather.—C. L. M.

In describing the meteorological work on the recent recruiting trip of the *NC-4*, it is necessary to explain the nature of the trip so that the reader may understand the conditions under which the work was done, the variety of conditions met, and the necessity of keeping on the schedule.

During the summer of 1919 the Navy Department decided that during the recruiting campaign of the coming fall the *NC-4*, with as many of the crew which had piloted it across the Atlantic in its memorable flight as possible would probably be the best advertising agency at its command. A trip was planned starting from the United States naval air station, Rockaway Beach, N. Y., early in September. The plan was to fly to Portland, Me., then south, stopping at all of the larger cities, to Miami, Fla., thence to Pensacola, Fla., for a day or two, and then up the Mississippi and Ohio Rivers to Cincinnati, Ohio. This last leg was to be made in two long flights. After visiting the Ohio city for three days, the journey south was to start, stopping at all the principal cities, to New Orleans, La., fly across